

Case Study

Low-Cost, Self-Install Alternative Water Supplies for Livestock Using Hydraulic Ram (Papa) Pumps



Installing a hydraulic ram pump SCRT/LIFE R4ever Kent/Mark Battista

Background

Fencing livestock away from rivers and becks is a key measure for protecting water quality and improving habitat condition.

Excluding stock:

- Prevents bank erosion and watercourse poaching, improving ecological status.
- Reduces fine sediment, nutrients, and faecal bacteria entering watercourses, improving livestock health and riparian biodiversity.

However, fencing out stock creates a challenge: **how to provide reliable drinking water**, especially in landscapes with **steep terrain, remote pastures, or no power supply**.

Traditional options include **direct secure drinking points**, which are only suitable where bank engineering is possible or **solar-powered pump and trough systems**, which are effective but can be costly and sunlight-dependent. This guide outlines a **simple, low-cost, no-energy alternative**: the **Papa Pump** hydraulic ram system.

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What is a Papa Pump?

The **Papa Pump** is a modern hydraulic ram pump that uses **flowing water and gravity** to pump a smaller amount of water uphill without any electricity, fuel, or solar power. It has only **two moving parts**, is compact and lightweight, and can lift water to elevations up to **100 m** depending on site conditions.

Key Benefits

- **Zero running costs** — uses only the energy of falling water.
- **No external power supply required**, making it ideal for remote, off-grid locations.
- **Low maintenance**, long lifespan, and minimal environmental impact.
- **Consistent 24/7 pumping**, unaffected by sunlight or battery charge levels. Hydraulic ram systems operate continuously when correctly installed.



Hydraulic ram pump SCRT/LIFE R4ever Kent/Mark Battista

How Does a Hydraulic Ram Pump Work?

Hydraulic ram pumps operate using the **water hammer effect** — a pressure surge caused when flowing water is suddenly forced to stop.

Basic principles:

1. Water flows downhill from a source into the pump via a drive pipe.
2. A waste valve repeatedly opens and closes as water accelerates.
3. Sudden closure produces a pressure spike (“water hammer”).
4. This pressure forces a small portion of water uphill through the delivery pipe to a tank or trough.

This cycle repeats 40–60 times per minute, producing a steady pumped supply 24 hours a day.

The Papa Pump is a refined, lightweight, modern version of this historic technology.

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Comparison with Alternative Water Supply Systems

Papa Pump (Hydraulic Ram) – Comparison

Feature	Papa Pump	Solar Trough	Battery Pump	Pasture Pump
Power source	None (water only)	Solar + battery	Battery	Livestock
Operating cost	£0	Low but battery replacement	Battery costs	£0
Elevation lift	Up to 100 m	Moderate	Low–moderate	<8 m
Flow	Continuous 24/7	Daylight-dependent	Intermittent	Animal-driven
Maintenance	Very low	Medium	Battery maintenance	Low
Cost	Pump + pipework typically low	High	Medium	Low
Best for	Remote steep sites with flowing water	Flat, sunny areas	Moderate lifts	Small herds

When is a Papa Pump the Best Choice?

Choose a Papa Pump when:

- You have **flowing water with at least 1–2 m fall**.
- You need to **lift water uphill**, even long distances.
- You want a **low-carbon, low-cost, low-maintenance** solution.
- You prefer **simple installation** that landowners can complete themselves.
- You require **year-round reliability**, including in cloudy, shaded, or remote valleys.
- You want **zero ongoing costs**.

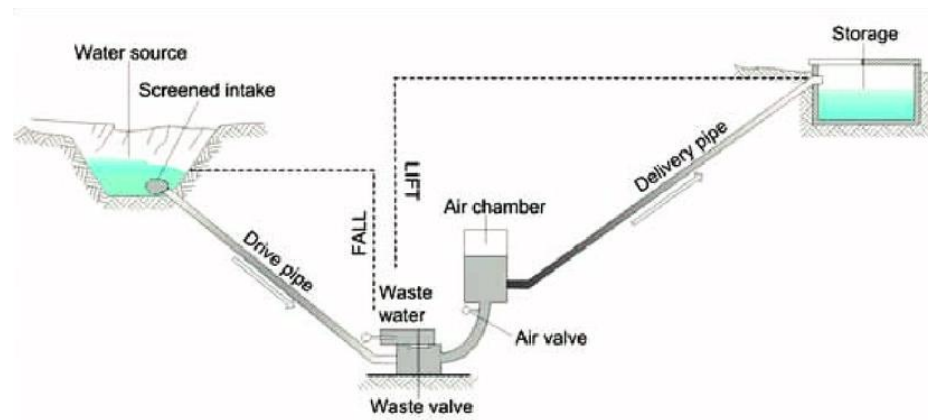
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Best Practice: Planning a Papa Pump Installation

Assess Your Site

You need:

- A **flowing water source** with at least 1–2 m vertical fall to the pump.
- Space for a **small upstream collection chamber or manhole** to feed the drive pipe.
- A location for the **pump housing** slightly downstream.
- A route for a **delivery pipe** to lead water uphill to a tank or trough.



Schematics of hydraulic ram pump

Key Components

A typical Papa Pump system includes

- Upstream manhole or screened intake.
- Drive pipe (typically 50–75 mm MDPE).
- Papa Pump in a downstream manhole.
- Drain to return waste water to the stream.
- Delivery pipe (25–32 mm MDPE).
- Storage tank or header tank feeding a trough.

Installation Steps (Practical Guide)

Step 1 — Construct Water Intake

- Build a small collection chamber/manhole upstream.
- Install a debris screen or filter to protect the pump.

Step 2 — Fit the Drive Pipe

- Lay pipe from intake to pump site with a steady downhill gradient.
- Avoid bends; straight runs maximise efficiency.
- Ensure airtight connections.

Step 3 — Install the Papa Pump

- Place pump inside a manhole or protective chamber.
- Include isolation valves to allow maintenance.
- Ensure the waste outlet discharges back into the watercourse.

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Step 4 — Fit the Delivery Pipe

- Install MDPE pipe from pump to storage tank.
- Aim for smooth gradients; avoid air traps.
- If necessary, add an air-release valve to prevent vacuum lock.

Step 5 — Install Storage Tank

Position the tank at the required elevation.

- Secure and protect from livestock.
- Connect to trough(s) via gravity feed.

Step 6 — Commissioning

- Start water flow into the drive pipe.
- The pump should begin cycling automatically.
- Check waste valve operation and delivery flow.
- Ensure no leaks or air entering system.

Maintenance and Monitoring

Hydraulic ram pumps require very little maintenance:

- Inspect inlet screens periodically.
- Check for debris after storms.
- Verify valves are cycling correctly.
- Monitor delivery volume; reduced flow may indicate air ingress or partial blockage.

Because the pump contains only two moving parts, long service life is typical.

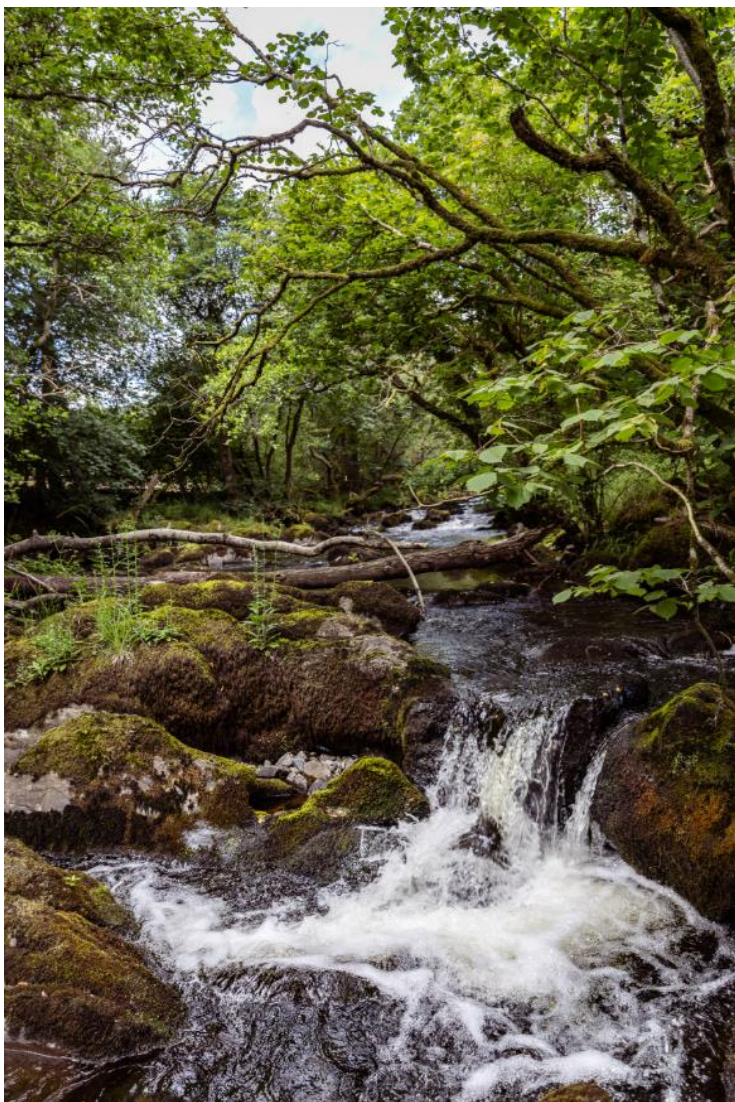
Costs and Funding

Hydraulic ram pumps are competitively priced and benefit from very low running costs. For comparison:

- Solar-powered livestock systems can cost **£3,000–£4,000**.
- Battery-powered kits begin around **£650** but require replacement batteries.
- RAM pumps may be eligible for **some rural development grants**.

With **zero energy use**, a Papa Pump typically pays back sooner than powered alternatives.

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Mark Battista

Case Study (LIFE R4ever Kent Trial)

The trial site in Cumbria had:

- **Very steep riverbanks**
- A nearby **public footpath**, limiting infrastructure options
- Inaccessible terrain for solar troughs
- Need to lift water to fence-excluded pasture
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As a part of undertaking river restoration on one site the watercourse was fenced off, restricting livestock access. The project priorities were to ensure ongoing water supply for the livestock while allowing the river habitat to flourish. Low cost and easy installation were the key desirability factors for the solution, so a hydraulic ram pump was installed. It was installed by hand on site by South Cumbria Rivers Trust and the land owner to a trough c.8m uphill.

It has proved successful, now having been in place for 2 years. The Papa Pump successfully provided a **no-energy, durable supply of clean water**, demonstrating suitability for similar challenging landscapes.

One lesson learnt was the importance of checking and ensuring the screen is clear and the correct size for the intake, as caddisfly larvae and leaves causing blockages were an issue in the first few months of installation, before the mesh was changed.

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